

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program



January 15, 2015

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**SECRETARY, BOARD OF
OIL, GAS & MINING**

TO: The Utah Board of Oil, Gas, and Mining

THRU:  Dana Dean, Associate Director
 Daron Haddock, Program Manager

FROM: Amanda Daniels, Hydrologist

RE: Crandall Canyon Mine Discharge Water Board Update, Docket No. 2010-026,
Cause No. C/015/0032

SUMMARY:

Attached please find the Division of Oil, Gas and Mining's six month update report on the total iron concentrations in the mine discharge water at the Crandall Canyon Mine. This report is submitted in compliance with the January 28, 2013 Board Order.

Crandall Canyon Mine Hydrologic Evaluation Update

January 15, 2015

Introduction

The Division of Oil, Gas and Mining (the Division) completed a Hydrologic Evaluation of the Crandall Canyon Mine Water Discharge in June 2010. Since that time, numerous reports have been prepared by the Division and Genwal Resources, Inc. (Genwal) that examine the mine discharge water at Crandall Canyon. In compliance with the January 28, 2013, Board of Oil, Gas and Mining (the Board) Order¹, the following report presents an update on the data collected through December 2014. The report will focus on data collected since approximately January 2010 (after total iron concentrations in the discharge peaked). The following sections of this updated report describe: the data currently being collected, plots which have been prepared to examine the data, and a recent data evaluation. Due to the most recently collected data, a predictive compliance analysis was not conducted, for reasons discussed in the report.

Sampling

Genwal has continued to perform monthly sampling and analysis of the mine discharge water in accordance with the Crandall Canyon Mining and Reclamation Plan (MRP). In addition, Genwal has been collecting laboratory analysis samples more frequently than required by the MRP and has also been sampling the discharge using a total iron field analysis. The sampling is conducted to evaluate the need for continued treatment of the mine discharge water in order to meet the 1.24 mg/L maximum daily effluent limitation (MDEL) for total iron in accordance with their Utah Pollutant Discharge Elimination System (UPDES) permit. In addition, treatment is required for compliance with the nuisances' standard of Section I.C of the UPDES permit.

In October 2012, Genwal installed a new continuous flow sampling port and began collecting samples at this port. In March 2013, the continuous flow sampling port was destroyed by a rock fall from a high wall. After consultation with the Division, a new continuous flow sampling port was installed in March 2013. For purposes of this report, data from both continuous flow sampling ports will be viewed as equivalent. All samples taken since March 2013 were collected at the new continuous flow sampling port.

Current Data Graphs

Untreated total iron concentrations from January 2007 through December 2014, with the Genwal compliance trend line², are shown in Exhibit 1. The monthly median total iron concentrations from January 2010 to December 2014 are plotted on Exhibit 2. Exhibit 3 shows only the continuous flow sampling port, monthly median total iron concentrations, from October 2012 to December 2014. Mine discharge water chemistry analytical results from January 2007 to December 2014 and monthly medians for total iron are tabulated in Exhibit 4.

Recent Data

Over the past seven months, June 2014 to December 2014, the individual total iron concentrations have fluctuated as low as 1.32 mg/L and as high as 2.99 mg/L with a seven month

average concentration of 1.6 mg/L and a standard deviation of 0.396 mg/L. Comparing this information to the previous 6 months, the average total iron concentration has stayed the same, but the standard deviation has increased.

Prior to July 2014, the total iron levels were more clearly trending downward on a defined path, but from July to December 2014 the data has become more varied. Due to the unstable nature of the most recent data, specifically that it does not appear to follow the previous trends, the method of analysis used in the June 2014 board update becomes a less accurate tool. A rate kinetics analysis⁴ will not be done in this report, but may be used in the future if the total iron levels resume a clearer trending pattern.

Compliant Discharge

Mine discharge water samples collected from June 2014 thru December 2014 all reported total iron levels above the MDEL of 1.24 mg/L. When looking at the monthly median, over the last seven months, the untreated mine discharge total iron concentrations have begun to slightly increase, but due to the short amount of time over which this variation in the data has occurred, more data should be collected before conclusions can be made about the new trend.

The Division would like to recognize that despite the most recent variation of untreated total iron concentrations, the treatment system in place and run by Genwal has been effective in maintaining discharge water in compliance with the MDEL.

Conclusion

It appears that due to fluctuation in the recent data collected, the projected timeframe for achieving compliant discharge is uncertain, but will definitely be extended. The Division is hopeful the total iron concentrations will return to a downward trend. However, with the most currently available data, the Division feels that it is most prudent to continue collecting data to support accurate evaluations to establish if the total iron concentrations will re-stabilize. The Division recommends continuing to compile total iron concentration evaluations every six months based on newly available data.

References

1. Board of Oil, Gas and Mining., Findings of Fact, Conclusions of Law and Order, Docket No. 2010-026, Cause No. C/0150032, January 28, 2013.
2. Petersen, E.C. 2011. Investigation of Iron Concentration in the Genwal Resources, Inc. Crandall Canyon Mine Discharge Water, November 7, 2011
3. Gilbert, R.O., 1987. Statistical methods for environmental pollution monitoring. Van Nostrand Reinhold, New York.
4. Perry and Rauch. Estimating Water Quality Trends in Abandoned Coal Mine-pools, Presented at West Virginia Mine Drainage Task Force Meeting (sourced online as a white paper), March 26-27, 2013, Morgantown, WV

Exhibit 1

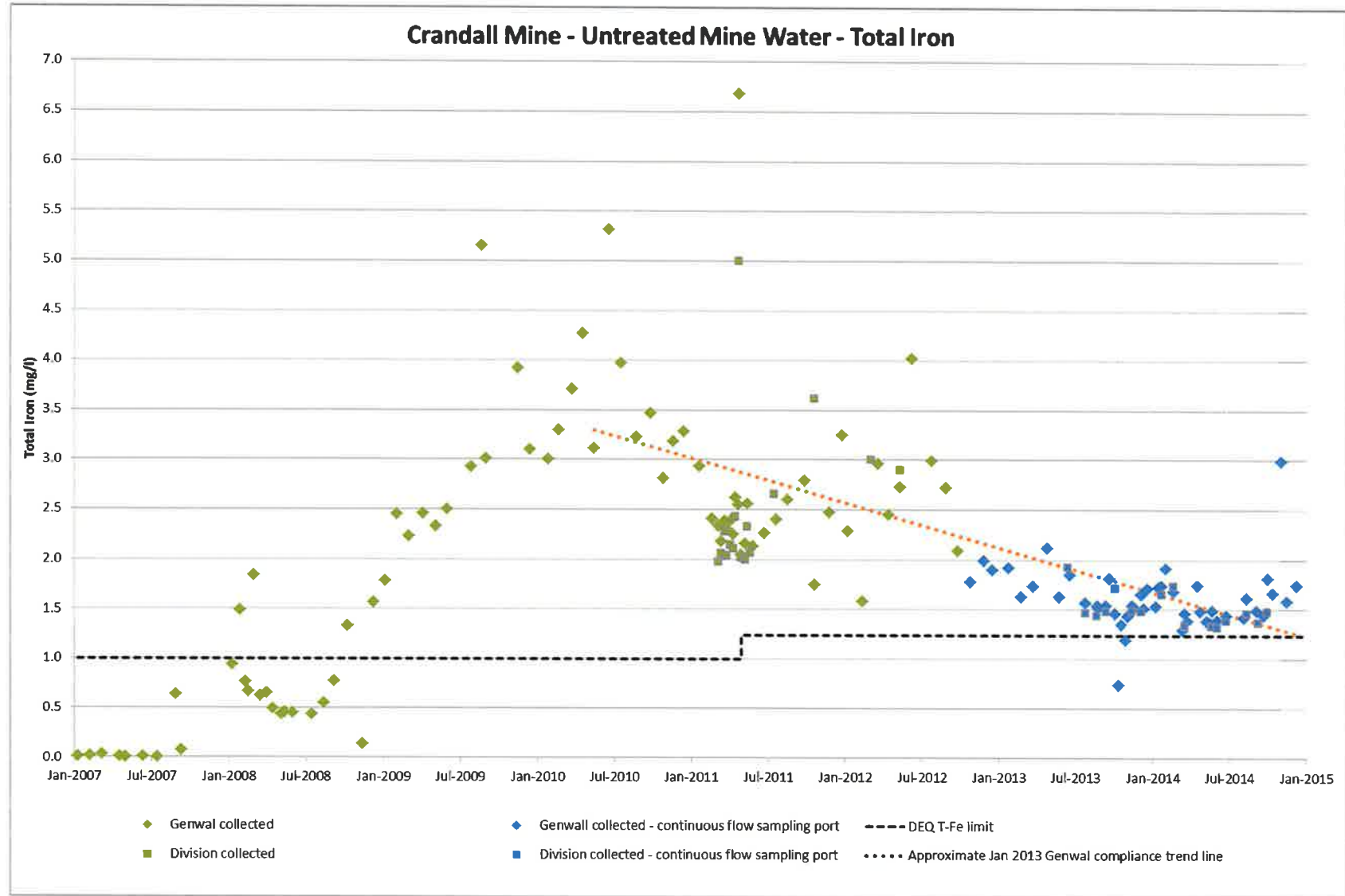


Exhibit 2

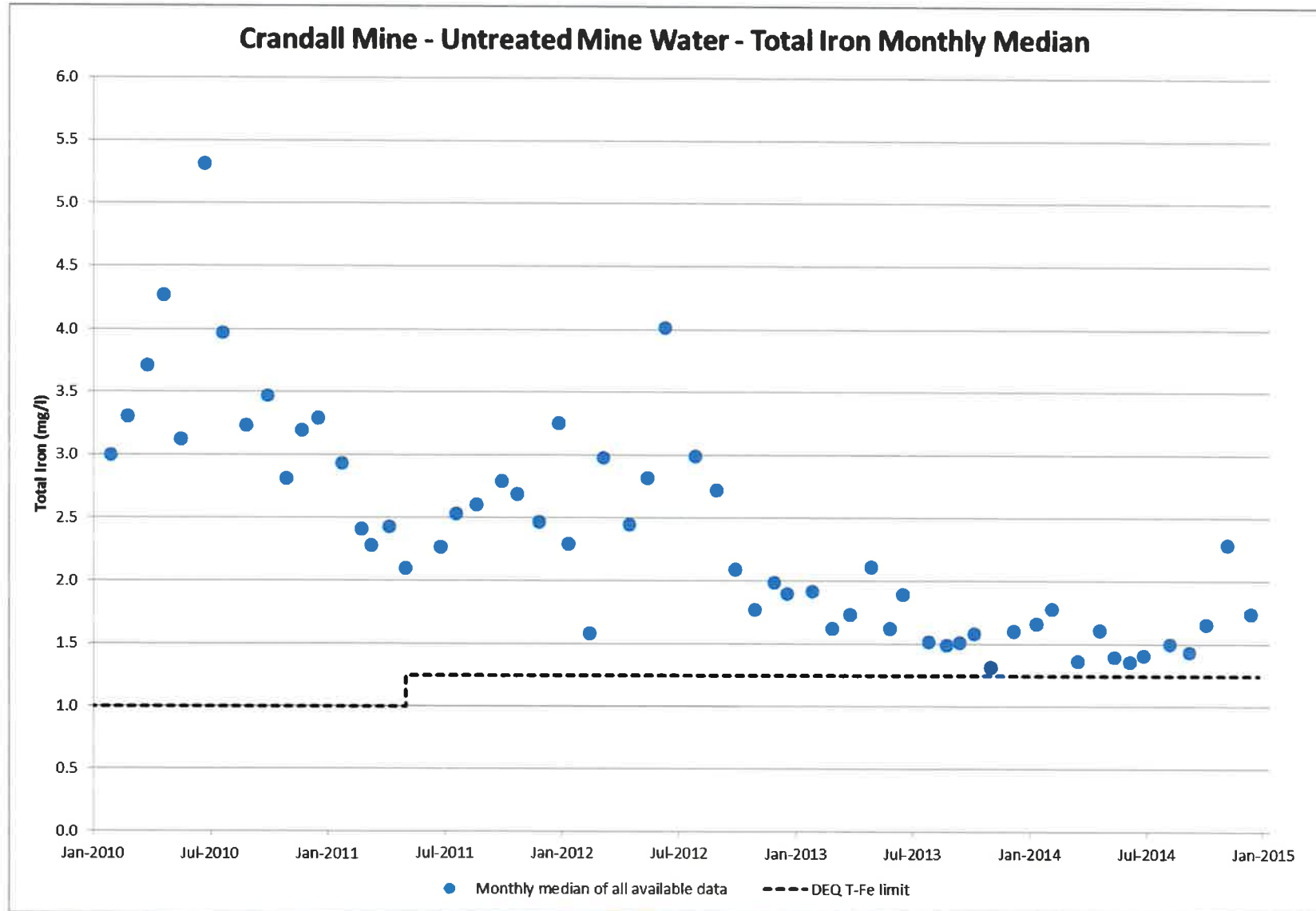


Exhibit 3

Crandall Mine - Untreated Mine Water Monthly Median - Continuous Flow Sampling Port

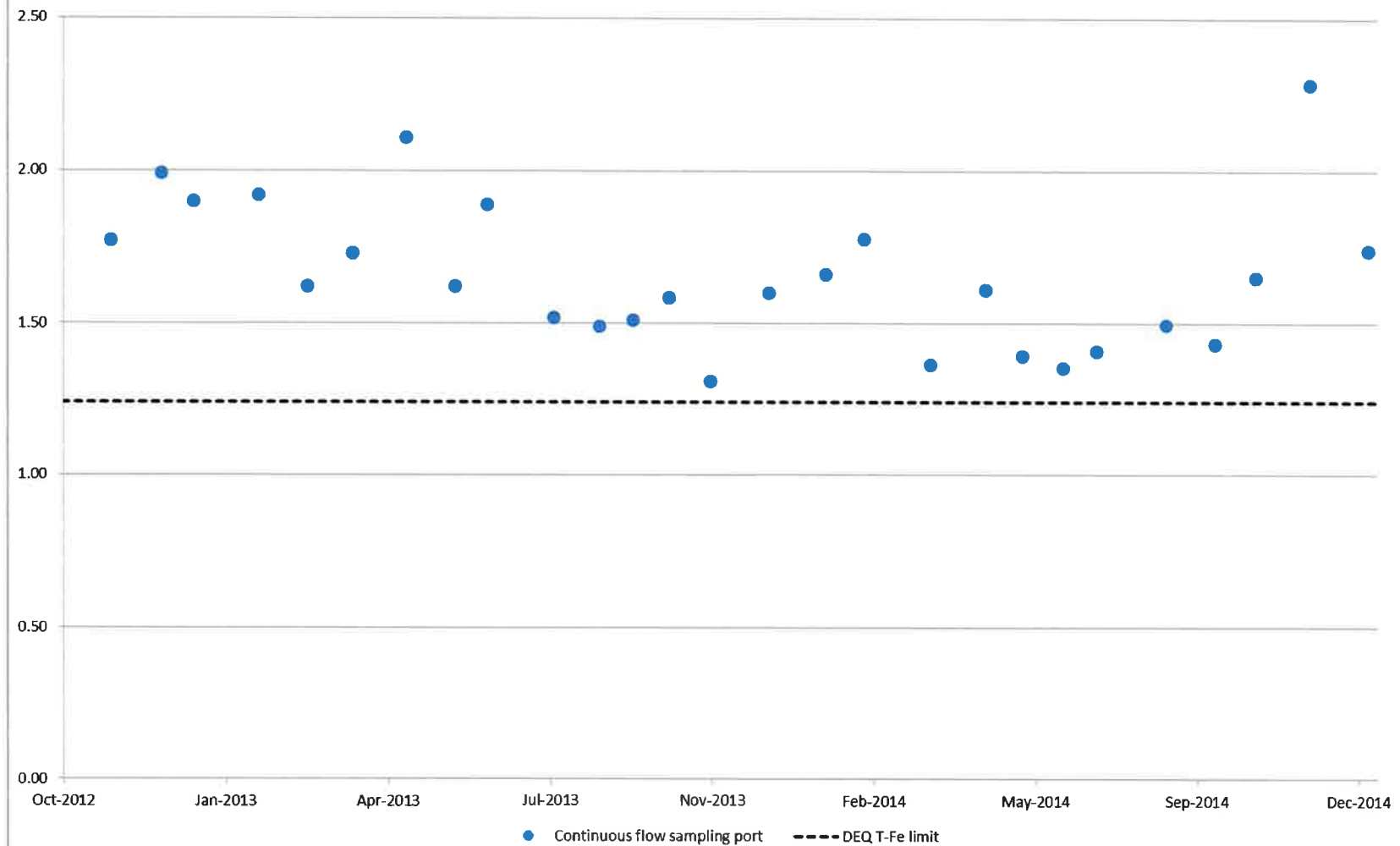


Exhibit 4

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
1/8/2007	0.012		G	
2/6/2007	0.015		G	
3/7/2007	0.033		G	
4/18/2007	0.013		G	
5/1/2007	< .005		G	
6/13/2007	0.012		G	
7/16/2007	< .01		G	
8/30/2007	0.64		G	
9/11/2007	0.073		G	
10/15/2007	no flow		G	
11/15/2007	no flow		G	
12/15/2007	no flow		G	
1/10/2008	0.937		G	
1/28/2008	1.491		G	
2/11/2008	0.765		G	
2/18/2008	0.668		G	
3/3/2008	1.846		G	
3/17/2008	0.626		G	
4/1/2008	0.653		G	
4/15/2008	0.491		G	
5/5/2008	0.433		G	
5/14/2008	0.457		G	
6/1/2008	0.448		G	
7/16/2008	0.434		G	
8/14/2008	0.546		G	
9/9/2008	0.775		G	
10/10/2008	1.335		G	
11/15/2008	0.141		G	
12/9/2008	1.569		G	
1/7/2009	1.783		G	
2/3/2009	2.454		G	
3/4/2009	2.23		G	
4/6/2009	2.455		G	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
5/6/2009	2.331		G	
6/3/2009	2.501		G	
7/29/2009	2.924		G	
8/24/2009	5.151		G	5.15
9/3/2009	3.012		G	3.01
10/28/2009	8.03		G	8.03
11/18/2009	3.927		G	3.93
12/16/2009	3.102		G	3.10
1/28/2010	3.000		G	3.00
2/23/2010	3.300		G	3.30
3/26/2010	3.709		G	3.71
4/21/2010	4.268		G	4.27
5/18/2010	3.119		G	3.12
6/23/2010	5.312		G	5.31
7/21/2010	3.970		G	3.97
8/27/2010	3.230		G	3.23
9/29/2010	3.470		G	3.47
10/29/2010	2.810		G	2.81
11/22/2010	3.190		G	3.19
12/17/2010	3.290		G	3.29
1/24/2011	2.930		G	2.93
2/23/2011	2.410		G	2.41
3/10/2011	2.340		G	2.28
3/10/2011	1.98		D	
3/17/2011	2.180		G	
3/17/2011	2.06		D	
3/24/2011	2.390		G	
3/24/2011	2.28		D	
3/28/2011	2.310		G	
3/30/2011	2.360		G	
3/30/2011	2.04		D	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
4/7/2011	2.390		G	2.43
4/7/2011	2.15		D	
4/14/2011	2.250		G	
4/14/2011	2.11		D	
4/19/2011	2.620		G	
4/19/2011	2.43		D	
4/26/2011	2.550		G	
4/27/2011	6.680		G	
4/27/2011	5.00		D	
5/3/2011	2.050		G	2.10
5/3/2011	2.02		D	
5/12/2011	2.160		G	
5/12/2011	2.00		D	
5/17/2011	2.560		G	
5/17/2011	2.33		D	
5/25/2011	2.07		D	
5/31/2011	2.130		G	
6/27/2011	2.270		G	2.27
7/21/2011	2.660		D	2.53
7/25/2011	2.400		G	
8/22/2011	2.600		G	2.60
9/30/2011	2.790		G	2.79
10/24/2011	1.750		G	2.69
10/25/2011	3.62		D	
11/28/2011	2.470		G	2.47
12/28/2011	3.250		G	3.25
1/12/2012	2.29		G	2.29
2/15/2012	1.58		G	1.58
3/7/2012	3.00		D	2.98
3/23/2012	2.96		G	
4/17/2012	2.45		G	2.45

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
5/15/2012	2.73		G	2.82
5/15/2012	2.90		D	
6/12/2012	4.02		G	4.02
7/30/2012	2.99		G	2.99
8/31/2012	2.72		G	2.72
9/30/2012	2.09		G	2.09
10/30/2012		1.77	G	1.77
11/30/2012		1.99	G	1.99
12/20/2012		1.9	G	1.90
1/29/2013		1.92	G	1.92
2/28/2013		1.62	G	1.62
3/28/2013		1.73	G	1.73
4/30/2013		2.11	G	2.11
5/30/2013		1.65	G	1.62
6/19/2013		1.93	D	1.89
6/24/2013		1.85	G	
7/30/2013		1.47	D	1.52
7/30/2013		1.57	G	
8/27/2013		1.44	D	1.49
8/28/2013		1.54	G	
8/29/2013		1.52	G	
9/17/2013		1.48	D	1.51
9/17/2013		1.54	G	
9/26/2013		1.81	G	
10/9/2013		1.71	D	1.59
10/9/2013		1.46	G	
10/17/2013		0.74	G	
10/24/2013		1.35	G	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
11/4/2013		1.19	G	1.31
11/8/2013		1.43	G	
11/14/2013		1.46	G	
11/19/2013		1.49	D	
11/19/2013		1.54	G	
11/26/2013		1.52	G	
12/10/2013		1.65	G	1.60
12/10/2013		1.48	D	
12/12/2013		1.65	G	
12/17/2013		1.51	G	
12/26/2013		1.71	G	
1/14/2014		1.53	G	1.66
1/22/2014		1.72	G	
1/28/2014		1.74	G	
1/28/2014		1.65	D	
2/7/2014		1.91	G	1.78
2/26/2014		1.68	G	
2/26/2014		1.74	D	
3/20/2014		1.29	G	1.37
3/25/2014		1.46	G	
3/25/2014		1.33	D	
3/31/2014		1.38	G	
4/23/2014		1.74	G	1.61
4/30/2014		1.48	G	
5/16/2014		1.38	G	1.39
5/23/2014		1.37	G	
5/28/2014		1.33	D	
5/29/2014		1.49	G	
6/10/2014		1.39	G	1.36
6/10/2014		1.32	D	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
7/1/2014		1.44	G	1.41
7/1/2014		1.38	D	
8/13/2014		1.42	G	1.50
8/19/2014		1.61	G	
8/19/2014		1.46	D	
9/12/2014		1.49	G	1.43
9/15/2014		1.37	D	
9/29/2014		1.44	G	
10/7/2014		1.48	D	1.65
10/9/2014		1.81	G	
10/20/2014		1.66	G	
11/10/2014		2.99	G	2.29
11/24/2014		1.58	G	
12/16/2014		1.74	G	1.74